[5040.1002]

TOUCHLESS BIOMETRIC RECOGNITION

[0001] The invention relates to a method for touchless recognition of biometric attributes of a body part, in particular of finger lines, comprising optical imaging from different points of view by several imaging facilities, observing and/or checking the position and/or the attitude of the body part to be recognized and/or correcting the images of the imaging facilities regarding the position and/or the attitude, wherein the shape of the body part is used.

[0002] In manifold applications, security systems are applied to refuse access to certain areas to unauthorized persons. Such areas are, for example, cash terminals, laboratory rooms to be kept secret and the like. These systems mainly use facilities for recognition of fingerprints and faces.

[0003] There are substantial attempts to overcome these systems. To increase the security, additional means are used, with which it is verified if it is the matter of a vital object.

[0004] In German Patent Document No. DE 101 23 561 A1, a method for identifying persons by means of biometric attributes of the finger tip is described, wherein both the shape of the finger tip and the fingerprint structures contained on the bottom side of the finger, including their spatial position and orientation on the finger tip, are detected as personal parameters by using images from different points of view by several cameras to create a three-dimensional profile of the finger tip and its dermal ridge structure. Thereby, the position and the rotation of the finger can be determined by means of an additional camera in front of the finger tip in order to ask the user for a correction of the position or to enhance the recognition analysis by the additional information of the degree of rotation of the finger.

[0005] In this method, the need of an additional camera for checking the position is disadvantageous, because the imaging facilities are the most expensive parts of an optical recognition apparatus.

[0006] The invention is underlied by the problem to specify a method of the type initially mentioned, with which an improved touchless biometric recognition is possible cheaply.

[0007] According to the invention, the problem is solved by a method comprising the attributes given in claim 1.

[0008] Advantageous embodiments are given in the dependent claims.

[0009] The advantage of the method according to the invention is that only a least possible number of imaging facilities is needed for the imaging from different directions, which fulfill two tasks at once and are therefore exploited more efficiently.

[0010] An improved recognition is possible by using the finger image or the finger model respectively across several phalanxes.

[0011] By measuring the respectively imaged nail surface, a simple and fast measurement of the degree of rotation of the finger is possible.

[0012] In the following, the invention is further explained considering examples of embodiments.

[0013] On this, it is shown by:

[0014] a schematic illustration of an arrangement for use with the method according to the invention.

[0015] In Figure 1, the two CCD cameras 2.1 and 2.2 exhibit an angle of 90° with respect to each other and are located in the planes separated by the angles ϑ and φ in a coordinate system x-y-z while taking images of the object 1.

[0016] In a recognition attempt, both cameras are taking images repeatedly until both cameras determine a finger position acceptable for the other camera respectively. This condition can be satisfied either for both cameras simultaneously or temporally one after the other.

[0017] The same statement is valid for arrangements with more than two cameras. Then, the

acceptances can be checked either pairwise or for a certain camera by a group or all of the other cameras respectively.

[0018] Two-dimensional images from certain points of view or three-dimensional models from the measurement data can be used as a reference and as a representation of the measurement data.

[0019] From the attitude, i.e., position, bending, degree of rotation, of the finger, a calculational transformation of the images to a finger in a „normal attitude" is possible, i.e., for example, in elongated attitude without twist, which is preferably also present in the reference images and reference models.

[0020] Thereby, the attributes of the finger's phalanxes and of the finger nail, i.e. thickness, width, length, are preferably also used in addition to the finger lines.

[0021] The degree of rotation of the finger can be calculated very easily from the nail surface respectively visible in the images.

[0022] The range of acceptance is clearly enhanced by the transformation to a „normal attitude", whereby the procedure is carried out essentially faster.

[0023] On the other hand, a feedback to the user can be given as long as a deviation of the position and/or attitude too large for a secure recognition is present, wherein the type and direction of the necessary change in position or attitude can be announced or displayed.

[0024] Alternatively or additionally, a feedback can be given as soon as the recognition has been carried out successfully to inform the user about the end of the procedure.

[0025] **List of reference numbers**

1	Object (Finger)
2	Light detectors
3	First light detector in plane xy
4	Second light detector in plane zy

[0026] ϑ, φ Angles of the coordinate system